

Culturable total and beneficial microbial occurrences in long-term nutrient deficit wetland rice soil

ABSTRACT

A study was conducted to find the effect of long term (24 years) soil macro nutrient deficit condition on total soil microbial population and occurrences of free-living nitrogen fixing and phosphate solubilizing bacteria (PSB) population in wetland rice cultivation system. After the 48th crop cycle (two crops of rice grown per year) soil and plant samples were collected before transplanting and maximum tillering stages from plots with the following treatments: (i) Complete fertilizers (NPKSZn), (ii) NPSZn (-K), (iii) NKSZn (-P) (iv) PKSZn (-N), and (v) without fertilizer. The total bacteria, fungus, actinomycetes, free-living nitrogen fixing bacteria and phosphate solubilizing bacteria populations were determined from each treatment. Results showed that total bacteria, fungus and actinomycetes population were high in the "complete fertilizer" treatment and low in "without fertilizer" treatments, which proved that the absence of any single nutrient element (N or P or K) decreased total soil microbial populations. Significantly high free-living nitrogen fixing bacterial population and high biological nitrogen fixation was found in "without N" fertilizer treatment. The highest atmospheric nitrogen fixed in the nitrogen-free broth culture (3.7%) was by the endophytic strains isolated from "without N" treatment. The Population of PSB was high in the "complete fertilizer" treatment. The highest phosphate (P) solubilizing activity (80%) was observed with the isolated PSB in "complete fertilizer" treatments. The isolated strains produced indoleacetic acid at rates of 1-9 mg l⁻¹. The results of soil chemical analysis showed that the soil N reserve was not reduced as compared to P and K, although the soil received the same treatments over the 24 years. In general, total microbial population was significantly affected by the absence of nutrient elements, whereas the absence of nitrogen increased the free-living nitrogen fixing bacteria.

Keyword: Atmospheric nitrogen fixation; Free-living nitrogen fixing bacteria; Phosphate solubilizing bacteria; Phosphate; Solubilization; Indoleacetic acid; Nitrogen; Phosphorus; Potassium; Yield